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Understanding the Impact of Economic Shocks on Labor Market Outcomes in Developing Countries

An application to Indonesia and Mexico

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Abstract

In this paper the authors use a search and matching model of multi-sector labor markets, to understand the channels through which economic shocks affect labor market outcomes in developing countries. In the model workers can be employed in agriculture, formal or informal urban jobs, or unemployed. Economic shocks are manifested as either increased turbulence in the formal/informal sectors or a decrease in overall sectoral productivity. By calibrating the model to Indonesia and Mexico, the authors are able to understand how the 1998 Indonesian crisis and the 2001 Mexican recession translated into labor market outcomes. They then venture to simulate how the current financial crisis might affect the allocation of labor and earnings across sectors, in these countries.

The results suggest that in both countries past crises have increased the degree of turbulence of the formal sector, increasing job destruction. However, while in Indonesia the crisis affected the overall formal sector productivity, this was not the case in Mexico. This explains the larger blow to formal wages—relative to the size of the shock- witnessed by Indonesian workers. The response of the informal sector was also different: In both countries the informal sector was able to act as a buffer, as relative earnings increased. However, while in Mexico it became much harder to find informal sector opportunities and easier to keep the job once found; in Indonesia turbulence in the informal sector increased substantially increasing the job destruction rate of informal jobs and limiting the cushioning role that the informal sector might have played. The agricultural sector was spared from the shock in both countries. In Indonesia, it actually benefited from an unusual exogenous increase in the price of rise.

The simulations show that if either the informal or agricultural sectors are spared from the shocks, large reallocations of labor might occur, and the overall effect of the shock is smaller. Instead, if these sectors can't buffer the shock, the reallocation of labor is much smaller, but earnings in the formal sector drop substantially. The authors also explore the impact of alternative policies. They find that in relatively flexible markets where informality can be seen more as a choice rather than as queuing, unemployment benefits and informal employment subsidies may have paradoxical effects, by discouraging formal search. Instead, policies targeted at creating informal employment and boosting formal TFP growth have the desired effects.

This paper—a product of the Poverty Reduction and Equity Unit, Poverty Reduction and Economic Management Network—is part of a larger effort in the department to understand the impact of economic shocks on employment and earnings. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at ppaci@worldbank.org.

Understanding the Impact of Economic Shocks on Labor Market Outcomes in Developing Countries: an application to Indonesia and Mexico

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1 Introduction

The past two years have reminded us that economic crises are recurrent events which leave long lasting effects on households' welfare, earnings and human capital accumulation, with the poor and vulnerable usually being the most exposed. Our capacity to cope with these effects and limit their long lasting effects depends crucially on the ability of governments to design coping mechanisms to off-set the short run effects without compromising long run growth (Paci, Revenga and Rijkers 2009).

Because in most developing countries, labor is the only asset of the majority of the population, labor markets play a crucial role in the way economic crises affect household welfare. Therefore, understanding of the way in which labor markets adjust is of tautological importance.

Labor markets can display very different responses to economic shocks depending on the institutional settings in place. Historically the brunt of adjustment has fallen on wages**.** For example average wages dropped by over 40% in Mexico and Russia and by 28% in Romania during their periods of crisis; manufacturing wages fell by over 20% in Russia, Brazil and Indonesia. But, in countries with more rigid wage settlements, employment has fallen: it dropped by 14% in Bulgaria in 1991 and by 11% in Chile in 1982 (against reductions of GDP of 6.4 and 7.1%, respectively). As employment in these sectors contracted, laid-off workers moved to low-productivity sectors and informal activities—such as agriculture, subsistence self-employment and small and medium enterprises—that act as "shock absorbers" World Bank (2009). Increases in unemployment, on the other hand can come result very different causes: it may be driven by lower job creation by formal firms, or by labor shedding by formal or informal firms.

To better mitigate the effect of shocks, policy should be tailored to the particular way in which labor markets adjust. For example, in countries where adjustment takes place though wages, income tax credits may perform well as a buffering mechanism. Instead, in countries where adjustment takes place through employment shedding from the formal sector, temporary holidays on payroll taxes or incentives for the financial sector to provide credit, might prove to be a better policy option. If the crisis is generating limited hiring in the formal sector, then temporary elimination of firing and hiring restrictions on new hires, or employment subsidies

may be a better strategy. If the informal sector is the main source of labor shedding, then the option of increasing credit to small and medium size enterprises should be seriously considered. In countries where the informal sector and the agricultural sector are unable to act as buffers, then public employment programs and unemployment subsidies are important policies to consider. Of course, all of these policies can achieve some gains in all dimensions. But certain policies might be more efficient at alleviating the stress of labor adjustment depending on the type of adjustment.

Our understanding of the response of labor markets to economic crises is still limited. While there is a fairly large set of studies that analyze the impact of different active and passive labor market polices during times of booms, our knowledge of their effectiveness in times of crisis is reduced. (Paci et. Al. Op. Cit.). Tracking flows of workers among different sectors of employment during economic downturns is one of the methods used to understand the nature of labor market adjustment (see Bosch and Maloney 2008), but requires panel data, which is scarce in most developing countries. General equilibrium approaches have also been attempted but provide little insight on the channels through which final outcomes are reached. The purpose of this paper is to contribute to our knowledge on the impact of crises on labor market outcomes in developing countries; as well as to provide some guidance on the potential impact of differing policies. Our approach differs somewhat from other methods. First, we provide a formal model designed to highlight i) the *channels* through which adjustment takes place, and ii) the effect of different policy options. Second, the model has the advantage of not requiring panel data and being able to accommodate disparate labor market structures; from those in which there is high unemployment to those in which unemployment is low. It is equally suited for labor markets with large agricultural sectors or large informal sectors.

The model presented here is a search and matching model in the tradition of Mortenssen and Pissarides (1994) and Pissarides (2000), extended to allow for multiple sectors: i) an urban formal or formal sector where productivity is high and there are returns to human capital, ii) an informal, or informal urban sector where productivity is low and there are no returns to human capital and iii) and agricultural sector that provides last resort employment, where workers receive the average product of labor. In addition there is costly rural-urban and urban-rural migration. Economic crises are modeled in two ways: i) as increases in the turbulence of the formal and informal sectors, which acts as idiosyncratic shocks that destroy formal and informal jobs; and ii) as economy wide shocks that reduce the productivity of all jobs in a given sector (formal, informal and agriculture).

This setting allows for a very rich set of channels through which economic crises might affect earnings and employment. To explore the impact of the crisis we calibrate the model to two very different economies: Indonesia and Mexico. We use past crises to understand the channels through which labor adjustment has taken place in the past. From these results we perform some simulation exercises to the impact of alternative policy responses. It is hard (and bold) to try to predict the effect of future or current economic crises on labor market outcomes. But we believe that understanding the response of the labor market to past crisis and the potential effect of alternative polices, will help in the difficult task of designing policies to mitigate the adverse effects of shocks on poverty and welfare.

The rest of the paper is structured as follows: the next section describes the stylized facts of the Indonesian and Mexican labor markets, including the response to past crises. Section 3 compares the institutional settings of their labor markets. Section 4 describes de model briefly and section 5 analyzes the *channels* through which labor markets transmitted the shocks to households' earnings and employment and we venture to simulate the effect of alternative policies. Section five concludes. The detailed description of the model and the calibration strategy used are left to the appendix.

2 Indonesian and Mexico, stylized facts

Mexico and Indonesia are middle-income countries with very different labor market structures. The Indonesian economy is still has an important agrarian economy with one third of its population employed in agriculture. In Mexico agricultural employment is only 17% of total employment. However, urban employment in Mexico is mostly informal (two thirds), while in Indonesia formal and informal sectors are roughly the same size (one third). In the past two decades both countries have suffered large downturns in economic activity. Indonesia was hardly hit by the 1998 Asian financial crisis, and Mexico saw two large downturns: the 1995 tequila crisis and later, in 2001, a somewhat smaller recession. The causes of the 2001 slow down are still unclear, but part of it has been attributed to slow down of the U.S. economy that made trade with the U.S. slow and affected mostly the manufacturing industry[1], and continued well into the first half of 2002. This paper will

[1] See Bosch and Maloney (2006)

concentrate on the 1998 financial crisis and, due to data limitations on the 2001 Mexican slowdown[2].

Both the Indonesian 1998 crisis and the Mexican 2001 slowdown, had important effects in the labor market, but displayed very different adjustment mechanisms. While Indonesia witnessed a strong reduction in real formal wages, the Mexican economy adjusted mostly through an increase of informal employment. Unemployment instead, responded only modestly. What explains such different outcomes? There are two potential explanations for this i) both economies faced very different institutional arrangements and ii) The shock was qualitatively different. We will explore both explanations.

2.1 The Financial Crisis and Indonesian labor market

The past two decades witnessed important changes in Indonesian labor market. The first half of the 90´s, prior to the financial crises, was characterized by rapid growth, an inflow of better educated workers to formal jobs, and a movement of unskilled labor away from farm jobs.[3]

During the financial crisis of 97-99, inflation caused a huge drop in real wages in urban areas, pushing many workers into poverty, and forcing women to enter the labor market in record numbers. This decrease in real wages probably mitigated the effect of the crises on urban formal employment, which decreased only slightly. Wage and earning drops among agricultural workers were partly mitigated by an increase in the prices of rice. This drop in real formal wages coupled with increases in agricultural earnings and increased female labor force participation explains the shift of the labor force to informal and agricultural activities.

The Asian financial produced a large blow to the Indonesian economy. Per capita GDP contracted by almost 15% during 1998. Despite this huge drop in economic activity, by 2000 unemployment had only increased by less than 2 percentage points. Instead wages in the formal sector decreased by 10%. Additionally, the formal sector contracted by 5%, shedding labor into the informal economy. Surprisingly, the recession was not reflected in survey household average labor earnings, which, by the year 2000 was almost the same as in 1997, the pre-crisis year. The main reason behind this apparent contradiction is that during the crisis

[2] To calibrate the model we need either unemployment duration or employment duration. Unemployment duration is only available beginning 1998 and employment duration beginning 2004.

[3] World Bank (2009)"Labor Market Trends in Indonesia. Jobs report" mimeo, World Bank, washington DC 2009. Pg. 3.

the Indonesian currency depreciated and the price of rise soared. These two effects buffered the effect of the financial crisis on agricultural households (33% of the workforce), whose incomes increased. Nevertheless, earnings in the urban economy decreased by almost 5%. Finally the duration of unemployment decreased. Table 1 shows the changes in labor markets caused by the crisis. We use 1997 as a benchmark pre-crisis year, and 2000 as the post crisis equilibrium. We use data for 2000, rather 1999 or 1998, is because by 2000 employment shares and wages had stabilized. We interpret this behavior as evidence that the post crisis equilibrium was reached in 2000[4].

Table 1: Indonesian Labor Market Adjustment

	1997	2000	% change
Share of workers (%)			
Share of Workers in Agriculture	33.16	32.9	-0.78
Share of Workers in Informal	26.25	26.84	2.25
Share of workers in Formal	35.89	33.96	-5.38
Share unemployed	4.7	6.3	34.04
Annual Earnings (Rupiah)			
Earnings in agriculture	3,686	4,916	33.37
Earnings in Informal	7,511	8,015	6.71
Earnings in Formal	10,628	9,541	-10.23
Average earnings in the economy	7,008	7,009	0.01
Duration of unemployment (weeks)	41.93	34.30	-18.26

It took the labor market several years to recover from the crisis. Even after GDP growth had resumed again, employment remained stagnant and workers continued to be pushed into agriculture, although at a slower peace. Salaried workers benefited from increases in wages and new legislation on severance pay, and the civil workforce witnessed massive downsizing. The two developments are blamed in part for the slow recovery of formal wage employment[5]. Only between 2003 and 2007 did industrial employment growth resumed again.

[4] See Figure 1.1 in the Indonesia Jobs Report (2009)

[5] Op. Cit.

2.2 The Mexican labor Market during the 2001 slowdown

Between 1985 and 2005 Mexico's labor market has mirrored changes in GDP. After witnessing a period of rapid growth, Mexico's economy stagnated between 1991 and 1994. Unemployment rose slightly and the share of formal jobs remained stagnant. In 1995 the Tequila crisis resulted in rapid unemployment growth, reached a decade high of 7%, as well an inflow of workers to informal sectors.. The crisis was short lived and GDP growth resumed in the five years following the crash. Unemployment shrunk below the pre-crisis level, and the share of formal jobs also recovered, although not quite reaching the pre-crisis share. The rapid recovery of the 1995 tequila crisis was partly engineered by a decreased of 35% in real wages, which was achieved by keeping nominal wages fixed and "allowing the devaluation-induced inflation to erode real magnitudes" (Bosch and Maloney, 2006, pg 11).

In 2001 the Mexican economy witnessed a new slowdown. Per capita GDP shrunk of 1% with almost no impact on an already very low unemployment rate. As mentioned above, the main adjustment mechanism in the Mexican economy was a contraction of formal employment of 2%, and an inflow of workers into agriculture and informality; as well as an increase in the duration of unemployment. The contraction of the formal sector was quite high vis a vis the effect of the recession on GDP, and contrasts starkly with the relatively small effect of the Indonesian economy on formal employment. Real formal wages in Mexico in fact increased by 5%, and informal earnings 4%. Only agricultural earnings suffered a blow, of almost 8%.

Table 2: Mexican Labor Market Adjustment

	2000-II	2001-IV	% change
Share of workers (%)			
Share of Workers in Agriculture	17.1	17.35	1.46
Share of Workers in Informal	48.77	48.88	0.23
Share of workers in Formal	31.57	30.95	-1.96
Share unemployed	2.56	2.82	10.16
Earnings (Monthly 2001 pesos)			
Earnings in agriculture (monthly 2001 pesos)	1,054	972	-7.81
Earnings in Informal	2,569	2,673	4.06
Earnings in Formal	3,815	4,022	5.43

Average Income in the Economy	2,638	2,720	3.12
Duration of unemployment (weeks)	5.8	6.4	10.33

3 Are institutional arrangements substantially different?

The changing labor performace of Indonesia since 1990 was acompained by important changes of institutional arrangements, as aresult of growing preassure of domestic and intenational actors, regarding working conditions and a demanding more active intervention in the labor market. During 1998 and 1999, several ILO treteas where ratified by Indonesia, but labor reforms came about only in the aftermath of the crisis with two major pieces of legislation: the Trade Union Law No. 21/2001 and the Manpower Law No. 13/2003. These two pieces of legislation increased labor protection and foster union creation.

This changes however did not affect the market until 2001. Before then Indonesia ranked amongst the most flexible labor markets in the region. Fixed term contracts where allowed to last up- to 5 years; severance pay rates where very low and compliance was weak; and there were strict laws regarding freedom of association with only one labor union allowed to operate. Minimum wage legislation was in place, but the government did not intervene in wage negotitions. During the first half of the 90's minimum wages almost doubled, but by 2000, minimum wages had stabilized around 50% of the average wage and the rate of non-compliance was 30%. This coupled with the fact that 80% of the work force in the formal sector had no formal contract, suggest that until 2000, despite of the existence of minimum wage legislation, minimum wages were not really binding.[6] This suggest that Indonesia´s faced the crisis under relative labor market flexibility.

Mexico´s labor markets are, at least in statutory terms moderately flexible, when compared to other Latin American Countries, and there have been no important reforms during the 1990's, although Garza (2002) suggests that flexibilization was achieved through collective agreements. In addition the implementing regulations related to worker training and safety and to labor inspection procedures were substantially simplified (World Bank 2008).

Pages and Heckman 2003 find that the cost of job security for Mexico is well below Latina American standards. Minimum wages do not seem binding, they are set at a level equivalent

[6] Op. Cit

to 35% of median wage, among lowest in Latin America, non complaince is less that 5%, and volatitlity in the past decades has been below 5% (IDB 2004).

Djankov et al (2004) compare labor regulation for 85 countries in 1997, by constructing severeal indexes. The employment law index measures effective protection of employed workers (rater than just statutory protection. The Collective relations law index measures the power of labor unions. Both indexes are measured in a scale of 0 to 1 with higher values indicatig more protection and larger worker power. The difference in the index of employment protection between Indonesia and Mexico seems rather small, with only a 0.1 difference (0.59 for Mexico and 0.68 for Indonesia. The difference in collective relations law index is a little higher: In Mexico it takes a value of 0.57 while in Indonesia the value is 0.39.

The above data suggests that at the time of the crises i) Both Indonesia and Mexico faced realtively flexible markets compared to their regional counterpart, and ii) although its difficult to compare the level of flexiblity we can safely conlude that at least, there were no starking differences between the two countries in terms of labor protection or collective agreements iii) If there is any area where the two markets can be considered different, it would be in terms of minimum wage, with indonesia having a higher minimum wage and a higher non-compliance rate.

Surprisingly one would expect that the country with the more rigid wage mechanism (Indonesia) would adjust through employment rather than wages. But as discussed above exactly the opposite was true. This brings into question the hypothesis that, compared to Mexico, wages in Indonesia where rigid.

We believe that given the apparently small differences described above regarding the institutional setting of the labor market, the wide discrepancies in the response of the labor market to the economic crises, may mean that the crises were qualitatively different and so had differing effects. In what follows we will explore this hypothesis.

4 Understanding the Impact of Crises on Labor Market Adjustment.

4.1 The Model

As we mentioned before, we believe our understanding of labor markets in developing countries has been hampered by the lack of a structural model that allows us to connect observed outcomes with economic forces, in a casual way.

With very few exceptions, current models of labor markets are strongly biased towards explaining developed countries labor markets outcomes, where there are only two possible states for active population: being employed or unemployed. In addition workers face no barriers to moving between states and the agricultural sector is treated as any other sector in the economy, all of which are equally productive. These assumptions reflect poorly on the reality of labor markets in developing countries, where unemployment is often a luxury that only the better-off can afford, and most of the population is employed in subsistence agricultural or low productivity informal jobs. To remedy this knowledge gap the Poverty Reduction Group at the World Bank has been developing a structural model of labor markets in developing countries (see Albrecht, Gutiérrez, Paci and Park, 2009, henceforth AAGPP), which takes into account the main specificities of LM in developing countries. The main objective of the model was to explicitly model the determinants of earnings and the allocation of labor in a multi-sector setting. And in particular, to be able to estimate the impact of economics shocks and labor market policies on labor market outcomes. For this reason the model is particularly suited to study the channels through which economic crises affect labor market outcomes. We use this model this model to explore how past crises have affected labor market outcomes in Mexico and Indonesia, as well as the impact of alternative policies.

The model developed by AAGPP 2009 is in the spirit of Mortenssen and Pissarides (1994) and Pissarides (2000), search and matching models, extended to allow for a multi-sector nature of developing countries labor markets. It follows closely Albretch et al (2008a); and Satchi and Temple (2006). Albretch et. Al. (Op. Cit) extend the model to allow for heterogeneous worker productivity and an informal sector, while Satchi et. al. (Op. Cit.) allow for urban rural migration. The model in AAGPP (2009) incorporates both heterogeneous skills and informal sector, as well as urban-rural migration. In addition, production in the formal and agricultural sector can be affected by other factors aside from skills and the amount of labor, capturing in

this way Total Factor Productivity. Below we will describe the main features of the model, readers interest in further detail are referred to AGPP (2009).

The main features of the model can be summarized as follows: At any given time workers can be in any of three states unemployed, employed in agriculture, employed in the urban informal sector or employed in the urban formal sector. Workers engaged in agricultural production (a share l_a) receive the average product of labor $y_a=A_a\ (l_a)^{\gamma-1}$. Workers can migrate from the rural sector to search for urban employment opportunities at a cost (M). When they arrive in the urban sector they start off as unemployed. The urban sector is composed by a high productivity wage sector with positive returns to skills (the formal sector); and a low productivity sector (informal sector) where workers receive a fixed income (y_0) regardless of their skills. While unemployed, workers can search for formal jobs, informal jobs or both. Informal employment opportunities arrive at an exogenous rate (α). Workers differ in skills, and skills determine the maximum level of productivity of workers in formal jobs: higher skill workers can produce more at output, for a given technology (A_1). The maximum productivity of a worker of skill *y* in the high productivity sector is A_1y. Firms post vacancies at a cost (c) and unemployed workers look for jobs, but there are frictions in the labor market, meaning that it takes time for workers to find jobs and for firms to fill vacancies. The rate at which workers and firms meet can be represented by a 'matching function' which states the number of encounters (m) that occur in the labor market. For a given number of exiting vacancies (v) and unemployed workers (u): $m=\xi(\Theta)^{\rho}$, where $\Theta= v/u$, can be interpreted as a measure of market tightness. Therefore, $m(\theta)$ is the rate of arrival of formal sector employment opportunities and is endogenous to the model. Once workers and firms meet they decide whether to engage in production and they bargain on a wage. The resulting wage will depend on the bargaining power of workers (β), and the difference between the benefit that both workers and firms can obtain from engaging in production, and their outside option. The economy can face two types of shocks: i) idiosyncratic shocks that hit some formal and informal jobs/firms, which arrive at a given rate determined by a Poisson process and; ii) sector wide shocks that affect all the jobs in a given sector. The rate of arrival of shocks to the informal sector will be denoted by δ and the rate of arrival of shocks to the formal sector will be denoted by λ. Economy wide shocks change the values of the technological parameters of the agricultural and formal sector production functions A_a and A_1, as well as the level of income in the informal sector y_o. Figure 1 below illustrates the structure of the labor market.

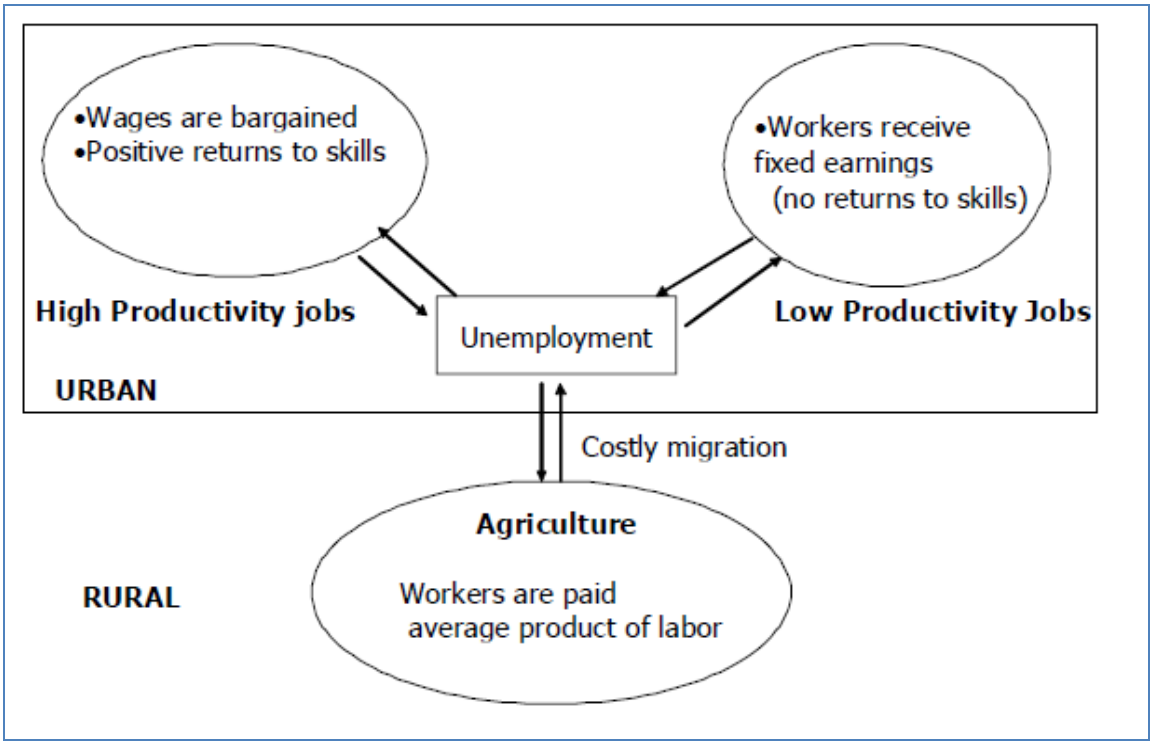

Figure 1: Structure of the Labor Market

The structure of the model results in a segmented labor market by skills, where low skill workers are located in agriculture, and higher skill workers are located in the urban sector. In the urban sector the lowest skill workers only search for informal jobs, workers within a middle range of skill can search for both formal and informal opportunities and high skill workers search only for formal jobs.

The endogenous outcomes of the model are: the share of workers in agriculture, formal and informal sectors; unemployment and its duration; earnings in the formal and agricultural sector; and the number of vacancies. The numbers of vacancies together with the unemployment rate determine the rate of arrival of formal employment opportunities. The threshold levels of skills that segment the labor market are also endogenous. These endogenous outcomes are determined by the exogenous parameters of the model: the distribution of skills (F(y)), the rate of arrival of shocks to formal and informal sectors (δ and λ, respectively), the rate of arrival of informal employment opportunities (α), migration costs (M), the costs of posting a vacancy (c); the parameters of the production functions in the formal and agricultural sector (A_1 and A_a), average earnings in the informal sector (yo); the interest rate (r); the bargaining power of workers (β) and; the two parameters of the matching function (ζ and ρ).

In this model economic shocks, such as the recent financial crisis, can affect the economy in two different ways. The first one is by increasing the turbulence of the formal and/or informal sectors, meaning that the rate of arrival of negative shocks to individual jobs increases (higer δ and/or λ) . In other words, a crisis makes it is more likely that a worker will loose a job in a given period. These are referred to as idiosyncratic shocks. Alternatively, economic shocks can affect all of the firms in a given sector, and can be interpreted as a change in the productivity of the sector (in real terms). Economy wide shocks, are modeled as reductions in the TFP of either formal (A_1), informal (yo) or agricultural sectors ($A_{a)}$. The next section describes briefly the calibration strategy. The annex describes the calibration in greater detail.

4.2 Calibration Methodology

The first step in the calibration is to define which workers will populate the informal (low productivity) and formal (high productivity) sectors, as well as the agricultural sector. We also need to take a stance on how we will define unemployment.

Only the active working age population (ages 15-65), was used to calibrate the model, the inactive are assumed to remain outside the labor force, as the model does not provide a mechanism to determine participation. A working age person was classified as active if he/she worked for pay at least one hour, worked at a family business for one hour, had a job or a business but was temporarily not working, or his/her primary activity was searching for a job in the past week. Those classified as active were then used to populate the different employment states.

For Mexico, workers were classified as: i) Unemployed if respondents' primary activity for the last week was job searching, ii) In the formal sector if respondents primary activity of the past week was working in non-agricultural activities, and social security coverage iii) In the informal sector if respondents primary activity for the past week was in non-agricultural activities without social security coverage and iv) In the agricultural sector if they were working in agricultural activities. For Indonesia, workers were classified as: i) Unemployed if respondents' primary activity for the last week was job searching, ii) In the formal sector if respondents primary activity of the past week was working in non-agricultural activities, the public sector, or working as private employees, iii) In the informal sector if respondents primary activity for

the past week was work as self-employed working alone or with unpaid family members in non-agricultural activities and iv) In the agricultural sector if they were working in agricultural activities. The Mexican classification of informality is based on social security, while the in Indonesia it has to do more with the type of employment. These distinctions were made based on data availability and the definitions used by the governments of these countries[7].

Most of the Information comes from household surveys. For Mexico the main source of data is the Encuesta Nacional de Empleo –ENE-; which provides information on employment status, duration of unemployment, occupational category, sector of employment, education, and earnings; for all working age individuals. The main source of data for Indonesia is the Indonesian Family Life Survey IFLS. However, we also use the SAKERNAS, household survey to estimate the unemployment rate[8].

After defining who will populate each sector we proceed to calibrate the model. Calibrating the model consists in finding the values of the parameters of the model that are consistent with the observed labor market outcomes. We need to calibrate 16 parameters. These are: two parameters that determine the distribution of skills among workers. We assume this distribution is a Beta type[9]. Income while unemployed; the bargaining power of workers β; the technological (or shift) parameter A_1 in the formal sector production function; the technology parameter from agricultural production function, A_0; the rate of arrival of shocks to the bad and formal δ and λ, respectively; the rate of arrival of informal sector employment opportunities α; the parameter determining the elasticity of labor in agricultural production γ; the migration cost M and the cost of posting a vacancy c; ξ and ρ, which correspond to the parameters of the matching function, $m(\theta)=\xi(v/u)^{\rho}$, the interest rate r and income in the

[7] Robustness checks were performed for other definitions with little change in the results.

[8] Both surveys show opposite trend in unemployment rate. The rate in IFLS declines during the crisis, whereas in SAKERNAS it goes up. As discussed in Smith et.al. (2000), "this discrepancy may be due to the different construction of survey questionnaire on employment status. Both surveys have the similar lead-in question. When respondents answered 'currently not working', SAKERNAS stop probing further, whereas IFLS asks two-step follow-up questions. First respondents are asked if they had worked for pay at least for one hour. If they answer 'No', then the second follow-up question probes whether they had worked in a family-owned business. " It is not hard to imagine that IFLS is expected to have low unemployment rate. Unemployment trend in SAKERNAS goes well with our conventionally idea that unemployent goes up during recessions.

[9] The beta distribution can take very different shapes depending on the values of the parameters, and has the advantage that is bounded both from bellow and above.

informal sector y_o. We also need to define the functional form for the distribution of skills and the idiosyncratic shock processes.

The calibration is performed in 4 steps. In the first step we set the values of 5 of the parameters using standard values from the literature. The value of leisure or unemployment benefit is normalized to zero b = 0. The bargaining power of workers is set β = 1/2. The interest rate is obtained for the Mexican Central Bank for Mexico and it is set to 4% for Indonesia. For the parameters of the matching function we set ρ = 1/2 and normalize ξ = 1. These are standard normalizations that do not affect the simulation results. We explore how sensitive our results are to the predefined parameters.

In a second step we determine the parameters of the production function in agriculture and earnings in the informal sector. According to the model, agricultural earnings y_a are the average product of labor: $y_a = A_a l_a^{\gamma-1}$. We use the value of the elasticity of output with respect to agricultural employment γ, estimated by other authors. For Mexico we use the elasticity found by Bravo-Ortega and Lederman (2004). For Indonesia we use the value estimated by Suryadarma et al (2007). Using the observed value of labor (l) and earnings (y_a) from the respective household surveys, we are then able to back-up the implied value of A_a, which corresponds to the technological parameter of the production function. Earnings in the informal sector are exogenous in the model, and we set them equal to the observed average earnings of all those working in this sector, which we obtain from the household surveys.

In a third first step we specify the parameters of the exogenous shock process G(y) that hit jobs and of the distribution of skills among active the working population F(y). As it is standard in the literature, we assume that the shock process is described by a uniform distribution with support [0, y]. In other words when a shock arrives the new level of productivity of worker of type y will be between 0 and y, with equal probability of ending up anywhere in this support. The uniform distribution is completely specified by its support. To model the distribution of skills of the labor force, F (y), we assume that skills are distributed according to the Beta distribution, and we proxy skill by the level of education of workers. The Beta distribution is a very flexible distribution with finite support between [0, 1]. Depending on its two parameters a_{beta}, and b_{beta} it can display a broad range of behaviors, it can be skewed or have a bell shape. Let a_{beta} and b_{beta} denote the two parameters. Then, the mean will be given by

$$E[y] = a_{beta} / (a_{beta} + b_{beta})$$

and a the variance will be given by

$$var[y] = a_{beta} / [(a_{beta} + b_{beta})^2 (a_{beta} + b_{beta} + 1)].$$

Using the mean and variance of education observed from the households surveys we can solve for the two unknowns a_{beta} and b_{beta}.

In a Fourth step we make use of all the parameters derived above to calibrate 5 of the remaining 6 parameters of the model: the rate of arrival of informal employment opportunities α; the job destruction rate of bad and formal δ and λ, respectively; the technology parameter of the good-jobs sector production function A_1 and, the migration cost (M). To do so we use five equations; these equations determine: i) the share of workers in the formal sector ii) the share of workers in the informal sector, iii) the average wage; iv) the duration of unemployment and v) the no migration condition. Our model gives very specific expressions for these quantities as functions of the parameters obtained in steps 1 through 3, and as a function of our unknowns: δ, λ, α, A_1, and M. These expressions are also a function of m(θ), which we do not observe because we do not have data for vacancies. This means we need a sixth equation to solve for the unobserved parameters. We use the loss function value, which is a non-linear function of the equations referred to in numerals i) to v). We find the values of δ, λ, α, M, A_1 and m(θ) that minimize the difference between the observed value of the target statistics and the corresponding theoretical expression derived from the model. For example, if the share of workers in the informal sector in is 24.6%, and the expression for the share of workers in the informal sector is given by a function n_0(δ, λ, α, A_1, m(θ);Φ), then the model minimizes 0.246- n_0(: δ, λ, α, A_1, m(θ);Φ); where Φ represents the other parameters of the model that where estimated in the previous steps. A higher level of detail can be found in the annex.

In the final step we calibrate the cost of posting a vacancy c. To do so we use all the previously estimated parameters and the free entry condition. This condition states that in equilibrium the profit from posting an additional vacancy is zero. Once we have m(θ) we are able to solve for the implied level of vacancies v.

This calibration strategy means that our model is set to match earnings in all three sectors, the duration of unemployment and the share of working age population unemployed,

employment in the informal sector, the formal sector and the agricultural sector, as well as the distribution of education.

4.3 Results

Using the above mentioned methodology we calibrate the model to a pre-crisis year and a year immediately following the crisis. This gives us the changes in the parameter values that are consistent with the observed change in the labor market during the crisis. For Indonesia we use 1997 as the pre-crisis year, and 2000 as the post crisis year. For Mexico we use the second quarter of 2000 as the pre-crisis year, and the fourth quarter of 2001 as the post crisis year.

As it was described in section 2, Mexico and Indonesia had different adjustment mechanisms. In formal wages in Indonesia decreased substantially (10%), while in Mexico they remained stable. Instead, in Mexico the reduction in formal employment was considerable, relative to the size of the shock. Unemployment increased slightly in both economies, from already low levels, with Indonesia witnessing a larger increase in the jobless. However, while the duration of unemployment decreased in Indonesia it increased in Mexico. Therefore the effect on unemployment was larger in Indonesia, but the jobless spent less time looking for a job than in pre-crisis times. Another major differences in both countries was that while the Agricultural sector in Indonesia benefited from the increase in the price of rise, protecting agricultural earnings from the crisis, in Mexico instead, agricultural earnings were hit hard by the shock.

In both countries the share of informal workers rose as well as informal earnings. Relative to the shock the effect on informality was larger in Indonesia. In addition informal earnings increased. The fact that informal earnings increased in both countries might run counter to general intuition, but there may be several explanations for this behavior. The first one is that the informal sector produces mostly non-tradable goods, while tradable goods are concentrated in the formal sector. The shocks that we are analyzing were ‘imported shocks’, in the sense that they started abroad and were transmitted trough trade and capital markets. Thus, one can expect that the effect of the shocks to be larger for firms that are more exposed to international markets. These firms tend to concentrate in the formal sector. In other words, in relative terms the crisis affected more the formal than the informal economy. The second explanation is that while workers that are shed from the formal sector to the informal sector are usually the least skilled workers, they end up being the most skilled when they arrive to the informal sector. If there are some returns to skills in the informal sector (which our model does not explicitly capture), average earnings will be boosted by the inflow of these relatively

more skilled laborers[10]. In both countries the share of the informal sector increased (almost 9% in Indonesia and a little less than 0.5% in Mexico).

Below we discuss the results of the calibration and how these results explain the differences in labor market adjustment displayed by the two economies. Tables 3 and 4 present the results.

Table 3: Calibration Results for Indonesia Pre and Post-Crisis

		Pre-Crisis 1997	Post Crisis 2000	% change
Agriculture				
Agricultural TFP	A0	0.14	0.18	32.47
Formal sector				
Formal Sector TFP	A1	1.74	1.55	-10.81
Rate of Arrival of Shocks to the Formal Sector Jobs	λ	1.41	1.15	-18.30
Rate of job destruction of formal jobs	-	1.02	0.87	-14.77
Rate of Arrival of Formal Sector Job Opportunities	m(θ)	7.83	6.26	-20.04
Duration of a Formal Job	d1	0.98	1.15	17.34
Vacancy rate	v	2.8821	2.4702	-14.29
Informal Sector				
Rate of Job Destruction in Informal Economy	δ	0.00	0.16	5607.14
Rate of Arrival of Informal Sector Job Opportunities	α	0.15	1.15	646.60
Duration of an Informal Job	do	354.50	6.26	-98.23

Table 4: Calibration results for Mexico Pre and Post-Crisis

	2000-II	**2001-IV**	**%**

[10] In addition, surveys in Indonesia have changes in the questionnaires that make classification of workers in the informal sector not strictly comparable. We are exploring this further to understand how much of this can explain the 19% increase in informal earnings.

		(Pre-crisis)	(post-crisis)	**change**
Agriculture				
Agricultural TFP	A0	0.17	0.16	-7.35
Formal Sector				
Formal Sector TFP	A1	2.05	2.09	2.21
Rate of Arrival of Shocks to the Formal Sector Jobs	λ	0.23	0.30	30.28
Rate of Job Destruction in Formal Economy		0.68	0.80	17.46
Rate of Arrival of Formal Sector Job Opportunities	m(θ)	7.89	7.97	0.98
Duration of a Formal Job (Quarters)	d1	1.47	1.25	-14.87
Vacancy Rate	v	1.78	4.06	128.14
Informal Sector				
Rate of Job Destruction in Informal Economy	δ	1.08	0.29	-73.59
Rate of Arrival of Informal Sector Job Opportunities	α	68.90	34.88	-49.38
Duration of an Informal Job (Quarters)	do	333.33	833.33	150.00

As expected, productivity in the formal urban sector is higher than in agriculture on both economies. In Indonesia, the increase in the price of rice that buffered the effects of the financial crisis for agricultural households is reflected as a rise in TFP. The reason is that our model does not contain relative prices, so that all changes in relative prices that affect earnings are reflected as changes in TFP. In Mexico, agricultural TFP remained relatively stable with a slight decrease slightly (-7%) limiting its cushioning role.

As for the effect on productivity in the formal economy, the crisis had two very different effects. In Indonesia the formal sector TFP decreased by 10%, which explains the decrease in wages, while in Mexico it remained stable. The lower profitability of jobs in Indonesia reduced labor demand, so the vacancy rate decreased by 29%. Instead, the Mexican crisis was reflected

by a higher rate of arrival of shocks to the formal sector, which increased 30%. Not only did more shocks arrive but these shocks resulted in a higher rate of job destruction, which meant a decrease in the duration of formal employment of 14%. The fact that TFP in the formal sector in Mexico increased slightly, explains why despite the higher turbulence more vacancies where created compared to the pre-crisis period. In Indonesia the effect of the crisis did not increase turbulence in fact, the rate of arrival of shocks to formal sector jobs decreased by 18%. However, because of the reduced profitability due to lower TFP, this lower rate of arrival of shocks to formal jobs did not reflect one to one in lower job destruction. Job destruction was indeed reduced, but only by 14%. In other words less shocks arrived but a higher fraction of this shocks ended up in jobs lost. The lower job destruction rate resulted in longer duration of formal jobs. The results suggest that while the Indonesian crisis acted as a sector wide shock in the formal sector, In Mexico it was reflected by higher turbulence in the formal sector.

Turbulence in the informal sector behaved very differently as well. In Indonesia turbulence increased substantially, skyrocketing the rate of job destruction, from a very low level. While the rate of arrival of informal job opportunities increased, it did so by a much smaller amount, resulting in substantial reduction of duration of informal jobs. In other words, volatility in the informal sector increased substantially with the Indonesian crisis. Instead, in Mexico, the informal sector seems to have been spared from the crisis. The rate of arrival of shocks decreased, so that informal jobs became much more stable, although jobs became harder to find. The fact that it became harder to find jobs in the informal sector explains the small rise in the duration of unemployment (one more week).

Summarizing we can see that the shocks took a different pattern in both countries. The main reason behind these differences is that in Indonesia the shock took the form of an overall reduction of formal sector productivity and in Mexico it took the form of an increase in the turbulence of the formal sector. Additionally while the informal sector in Mexico was spared from the shock, in Indonesia informal workers faced higher turbulence. Finally in Mexico agriculture witnessed an overall reduction in TFP (-7%), while in Indonesia the opposite happened. In Mexico the agricultural sector's productivity was reduced relative to other sectors and earnings decreased, but because finding jobs in the formal sector became tougher, migration to the cities did not take place.

Therefore although in both countries the informal sector increased its share of employment, the reason behind this increase appears to differ: labor shedding from the formal sector in Indonesia was a result of overall lower productivity in the formal sector, while in Mexico it was

the result of a lower rate of job creation and a higher rate of job destruction in the formal economy.

5 Policy Simulations

In this section we venture to simulate the effect of different policies on the labor market outcomes. We simulate what would have happened if during the crisis certain policies had been adopted.

We simulate four different types of policies: i) policies targeted toward increasing informal (or low income) job creation, such as microenterprise credit and public works that paid average informal wages, ii) subsidies to informal workers, iii) unemployment subsidy, and iv) boosts to formal sector TFP such as overall economic stimulus for investment, or credit.

To model an increase in job creation, we assume that policy is able to increase the likelihood of finding informal or low earning opportunities, and we simulate a 5% increase in the rate of arrival of informal jobs. Credit to informal enterprises or public work programs at a wage lower than the one prevailing in the formal sector, could be two such policies.

Subsidies to informal workers are just modeled as an additional component of informal earnings. With the subsidy, informal workers earn $y_0 + s$, where we assume s is 1% of the pre-crisis GDP divided by the number of informal workers. In other words, the government devotes an amount equivalent to 1% of GDP in the pre-crisis year, to give lump sum subsidies to informal workers, with each worker receiving a fixed amount of money. To simplify the computation we assume that the subsidies come in the form of foreign aid. In other words there is no need to finance the subsidy with domestic resources.

Unemployment benefits are modeled in a similar way: we assume that the government spends 1% of pre-crisis level GDP to transfer funds to jobless workers, and each unemployed receives a fixed amount of benefit.

Finally we assume that policies targeted towards overall economic stimulus are captured mainly by increases in formal TFP. We simulate an increase in formal TFP, equivalent of 5% of pre-crisis formal TFP.

All the policies are performed ceteris paribus, meaning that other exogenous variables would be as observed during the crisis. The results for Indonesia are shown in table 5 and the results for Mexico in table 6.

If Indonesia had adopted a policy able to increase the job finding rate of informal sector opportunities by 5%, agriculture would have absorbed almost half of the formal displaced workers and formal employment would have shrunk by 2 additional percentage points. The informal sector would have increased by 4 percentage points more than in the absence of the policy. Despite of this increase in informality, average earnings in the economy would have been slightly higher, (0.5 percentage points higher). There are three main reasons behind this behavior: earnings in agriculture would have been boosted by a smaller inflow of workers, wages would have been 1% higher, due to less congestion in the search for formal jobs, and finally unemployment rates and the duration of unemployment would have been smaller.

A subsidy to informal workers instead would have had a paradoxical result: a decrease in average earnings in the economy. Despite of the fact that the subsidy implies higher earnings for all the employed workers, it generates a substantial rise in unemployment (37% with respect to the pre-crises level) and a reduction in formal employment of 13% against 10% in the absence of policy, thus more workers have zero earnings or low informal earnings. The intuition is as follows: because now work in the informal sector carries a premium, more workers migrate to the cites in order to search for informal jobs increasing unemployment; less workers are now willing to search only for formal jobs and more workers and now willing to search only for informal jobs. This makes the formal market less congested, raises wages and reduces the formal employment share. The vacancy rate, which measures the number of vacancies as percent of total employment, would have decreased slightly less than in the absence of policy, but mainly due to the smaller share of employed workers. The larger share of informal workers and unemployed implies lower average earnings. The informal employment subsidy acts much like an unemployment benefit: it fosters migration to the cities, decongests the urban labor market and raises unemployment. Table 5 shows that unemployment subsidies would have produced similar results. However reallocation of labor would have taken place by movements to unemployment rather than to informality.

Because the Indonesian shock affected mostly formal sector TFP it would seem natural that policy would be targeted towards boosting overall TFP, with policies such as economic stimulus to investment or credit. The last column of table 5 shows the results for Indonesia. Despite of the fact that such policy would have ameliorated labor shedding by the formal sector, average earnings in the economy would have been only slightly smaller than in the absence of policy. The explanation for this is explained by the fact it the policy would have increased unemployment. Why? Because the higher turbulence in the informal sector generated by the crisis would have made informal employment vis a vis formal employment,

thus more workers would be willing to wait for formal sector jobs, that would have become more stable and better paid with the economic stimulus. We also performed a simulation with a 10% increase in formal TFP. In this case average earnings of the economy do increase, since the higher wages in the formal sector more than compensate for the increase in the number of jobless.

Table 5: Indonesia. Labor Market Outcomes with Policy.

		% change with respect to pre-crisi level				
	Benchmark post crisis outcome	Post crisis	Increase in rate of informal arrival oportunities (5%)	Subsidy to informal workers	Unemployment benefits	Overall economic stimulus to formal sector 5%
Employment shares						
Agriculture	32.90	-0.78	-1.78	-4.89	-6.03	-0.60
informal	26.85	2.29	6.02	17.87	9.60	-15.35
formal	33.96	-5.38	-7.08	-13.40	-8.33	7.41
unemployment	6.30	34.04	32.98	37.02	52.55	33.40
Earnings						
Agriculture	0.49	33.37	34.70	39.01	40.67	33.13
informal	0.80	6.71	6.71	10.26	6.71	6.71
formal	0.95	-10.23	-9.90	-9.51	-8.21	-6.71
average	0.70	3.07	3.56	2.27	1.76	3.04
Vacancy rate	2.47	-14.29	-9.71	-14.59	-11.67	7.21
Duration of unemployment	0.66	-18.26	-21.54	-10.32	0.56	-29.56

Table 6: Mexico. Labor Market Outcomes with Policy

	Benchmark post crisis outcome	% change with respect to pre-crisi level				
		Post crisis	Increase in rate of informal arrival oportunities (5%)	Subsidy to informal workers	Unemployment benefits	Overall economic stimulus to formal sector 5%
Employment shares						
Agriculture	32.90	2.33	1.31	-4.89	-6.03	-0.60
informal	26.85	5.50	9.35	17.87	9.60	-15.35
formal	33.96	-2.41	-4.17	-13.40	-8.33	7.41
unemployment	6.30	-17.11	-17.76	37.02	52.55	33.40
Earnings						
Agriculture	0.49	33.37	34.70	39.01	40.67	33.13
informal	0.80	6.71	6.71	10.26	6.71	6.71
formal	0.95	-10.23	-9.90	-9.51	-8.21	-6.71
average	0.70	3.07	3.56	2.27	1.76	3.04
Vacancy rate	2.47	-29.33	-25.56	-14.59	-11.67	7.21
Duration of unemployment	0.66	-18.26	-21.54	-10.32	0.56	-29.56

6 Conclusions and recommendations

This paper uses a three-sector search model to understand the effects of shocks on labor markets in developing countries. We find that Indonesia and Mexico displayed very different patterns of adjustment as a response to the crisis. Though labor market institutions differ in both countries it is hard to argument that this is the main reason behind this apparent difference. In fact, it is safe to say that both markets were fairly flexible when economic hardship struck. Instead, the model suggest that the shocks where qualitatively different. While in Indonesia the crisis reflected in an overall decrease in formal TFP, in Mexico it reflected in higher turbulence of formal sector jobs. The crisis also had qualitatively different effects on Informal sectors. While in Indonesia the informal sector became much more turbulent, in Mexico the informal sector was almost spared from the shock.

We use the model to simulate different policy options. The results suggest that policies have very different outcomes in terms of sectoral earnings and labor allocation. But differences in average earnings are much smaller. In relatively flexible markets where informality can be seen more as a choice rather than as queuing, unemployment benefits and informal employment subsidies may have paradoxical effects, by discouraging formal search. Instead, policies targeted at creating informal employment and boosting formal TFP growth have the desired effects.

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